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ABSTRACT

A technique is described for private liberal arts colleges to assess the probable matriculation behavior of admitted applicants. By performing a multiple discriminate analysis of data obtained from applicants admitted during a previous admissions season, and applying the information to a decision-making strategy used in political elections the procedure can be used to increase the institution's yield. The method calls for complete and detailed data on applicants from the immediately preceding admissions season which provides the basis for differentiating between those who enrolled at the target institution, and those who matriculated at competitor schools. In addition, information from the analysis of this data set must be applied to findings on currently admitted applicants in order to build a prediction function consisting of the factor weights produced from the initial data with the available data and currently admitted applicants. The information, subject to the prediction equation, produces categories of candidates with a high, intermediate, and low probability of matriculating at the school. Included in the paper is a detailed description of the application of this system to the admissions process at Whitman College (Washington) in 1988. (JB)

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AIR Professional File

Increasing Admitted Student Yield Using a Political Targeting Model and Discriminant Analysis: An Institutional Research-Admissions Partnership

Ronald F. Urban
Director of Institutional Research
Whitman College

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Introduction

During the current period of comparatively fewer 18 to 24 year-old high school graduates, admissions officials repeatedly must confront two challenging issues: 1) achieving the budgeted class size, and 2) ensuring the appropriate academic "quality" of the entering class. Recent evidence indicates that the impact of the much-discussed demographic decline finally is being experienced by many institutions in the form of fewer applications and, as the result of increased competition, lower yields (Wilson, 1990). While no shortage of information exists concerning techniques to expand the number of inquiries and applications from highly qualified applicants, the practical concern of encouraging a greater percentage of admitted candidates to enroll at the target institution (i.e., increasing yield) has received somewhat less attention. Consequently, institutions with competitive admissions policies may find utility in predicting the likely enrollment of each admitted applicant. With such information admissions personnel would be able to utilize yield enhancement resources more effectively, thereby improving their institution's capacity to enroll desired students. In this regard the office of institutional research can provide useful assistance by specifying the likely matriculation outcomes of admitted applicants.

This paper presents a technique to assess the probable matriculation behavior of applicants admitted to a private liberal arts college, although the basic ideas can be extended to other types of institutions, as well. By performing a multiple discriminant analysis of data obtained from applicants admitted during a previous admissions season, and applying the information to a decision-making strategy used in political elections, this essay describes a procedure that can be used to increase the institution's yield. Moreover, depending on the size of the admitted applicant pool, and existing computer capabilities, the statistical procedures can be completed either on micro- or mainframe systems.

Conceptual Background

In preparing for local and national elections, political experts seldom spend resources on geographical areas or precincts that produce consistently poor results for their candidates. For example, a Republican candidate seldom allocates costly resources to historically liberal neighborhoods because experience indicates that it is usually very difficult to convince these voters to cast their ballots for a conservative candidate. Similarly, targeting strategists generally do not concentrate major resources in precincts that traditionally have performed very well for their candidate. Thus, a Republican candidate typically does not spend much time and effort in traditionally very conservative areas. The reasons for this strategy are straightforward: first, it is comparatively difficult to produce attitude or behavior change among those who are firmly committed to the opposition; and second, seeking to convert those already embracing the desired candidate approximates "preaching to the choir." In sum, political experts do not exhaust resources on voters who are likely to be unreceptive, nor on those who are solid supporters of their candidate. Instead, voting behavior pundits typically focus their attention on "swing" neighborhoods or precincts--those with approximately equal numbers of sympathetic and unsympathetic voters (Salmore and Salmore, 1989). Utilizing this approach, experts maximize their efforts in terms of securing the largest possible number of votes.

While not completely analogous to the political process, election targeting strategy can be used to enhance admissions yield at colleges and universities. From an admissions perspective, not all admitted applicants represent equally attractive choices to the institution. Generally, those with superior academic credentials receive more post-admission attention than those with less favorable records. However, not all outstanding candidates represent likely matriculation prospects, and by exhausting resources on those who

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probably will enroll at other institutions, admissions officers may be allocating post-admission conversion resources inefficiently. Alternatively, by developing the means to identify the probable enrollment choice of all admitted applicants, admissions officials can make more effective use of available resources, thereby improving their institution's yield. Additionally, the more efficient use of resources permits the reassignment of "more costly" techniques to the most desirable applicants. A central concern of this discussion, therefore, focuses on the issue of: "Which admitted candidates should receive what kinds of admissions conversion resources?" At this point the general model employed by political strategists can provide some guidance.

Related Research

Although a review of the literature on the college selection process reveals the existence of sophisticated methodology and an emerging theoretical foundation, with certain exceptions, the available sources do not provide information that admissions offices can translate directly into practical action in order to increase yield. For example, Litten, Sullivan, and Brodigan (1983) describe a plan that some have described as a model admissions marketing approach, but their efforts focus largely on increasing the number of applications from the appropriate categories of students. Similarly, quantitative models (Zemsky and Oedel, 1983) have been produced that enhance the development of college selection theory, but such information frequently is not readily available to admissions officials.

Other researchers have studied phenomena associated with post-admissions outcomes. Kissel (1986), for example, utilized academic performance criteria in order to develop a technique to predict the classification status of students enrolling in a remedial education program, but the methodological assumptions were not clearly specified, nor presented in a form that can be duplicated readily by admissions officers.

In contrast, Sanders (1989) has developed a strategy that continuously assesses the enrollment potential of individuals in the applicant pool for differential treatment by the admissions staff. Similarly, the present essay seeks to present a decision-making process that is reasonably easy to reproduce, contains intuitive appeal to admissions officials who may lack a background in statistical methods, and can be performed either on micro- or mainframe computers.

Methods

Overview. In order to develop a useful measure of currently admitted applicants' probable enrollment, two different sources of information must be examined by the researcher. First, reasonably complete and detailed data on applicants from the immediately preceding admissions season must be available. This provides the basis for differentiating between those who enrolled at the target institution, and those who matriculated at competitor schools. Data can be obtained from the previous year's official admissions records, an admitted applicant survey, or from a combination of both (assuming that a unique means of identifying each individual appears in all files). It may be known, for example, that students from a given geographical area are more likely to enroll at the target institution than at other schools, or that students intending to major in high-status professions tend to enroll elsewhere, and so forth. Ultimately, the researcher seeks to combine all relevant information into a single numerical measure that can be used to assess the actual vs. predicted enrollment behavior of each admitted student. Although several multivariate techniques are available to compute the required prediction measure, the present study uses multiple discriminant analysis.

While the current discussion of multiple discriminant analysis necessarily must be limited, a thorough yet nontechnical account appears in Klecka (1980). In brief, multiple discriminant analysis explores the relationships between a dependent variable consisting of actual groups or categories, and a set of independent (predictor) variables. That is, the dependent variable consists of predicted group membership-in the present instance the categories "enrolled at the target institution," or "enrolled elsewhere." Moreover, the procedure assesses the relative contribution of each predictor variable in determining into which group a given individual should be classified. Certain statistical criteria indicate whether or not a specific predictor variable is sufficiently related to the dependent variable to justify its inclusion in the prediction equation. The usefulness of the equation, or model, ultimately is judged by its ability to classify individuals used in the analysis into the correct original groups. The percentage of successful classifications, usually adjusted for random assignment, represents the model's effectiveness.

Next, information gained from the multiple discriminant analysis of the initial data set must be applied to findings on currently admitted applicants. Again, the data may be acquired from official records, a mailed questionnaire, telephone interviews, or some combination of these procedures. The newly acquired information is used to build a prediction function, consisting of the factor weights produced from the initial survey, along with the available data on currently admitted applicants. The prediction equation then can be divided into appropriate categories of candidates with a high, intermediate, and low probability of matriculating at the target school, and lists of applicants' names in each of the categories subsequently can be supplied to the admissions office. Of course the process is most useful only if it can be completed between the time a student is admitted and when he or she must submit a deposit.

It must be pointed out that this technique is not intended to produce a generalized theory of admissions yield, but rather serves as a practical tool to enhance student matriculation. Thus, the researcher's model should be evaluated in terms of pragmatic considerations--do the selected variables produce an equation that contributes useful results? Once a stable set of predictors subsequently has been identified, efforts to develop a systematic theory might be possible.

Example. During the 1988 recruiting season at Whitman College, a survey of admitted applicants was conducted during which time attitudinal, academic, and socioeconomic information was obtained[1]. These data elements were chosen because their relevance to the enrollment decision process had been established in previously published research (e.g., Zemsky and Oedel, 1983), and because earlier locally conducted studies suggested differences in certain characteristics between enrolling and nonenrolling applicants. Several of the variables subsequently were incorporated into a predictive equation using the Discriminant program of SPSS, and the final model consisted of five independent variables. The coefficients and associated evaluative statistics appear in Table 1.

[1]The survey consisted of a mailed questionnaire with two follow-ups. The final response rate was 77%.

Table 1

Analytic Summary of Multiple Discriminant Analysis

Variable	Standardized Coefficients	Unstandardized Coefficients
High School GPA	-.44572	-.9197503
Verbal SAT	.15137	.0019113
Math SAT	.20892	.0025399
Family Income	.21380	.1648567
No. of Applications	.81443	.3818045
(Constant)		-3.651916

Canonical Correlation	.462
Wilkes Lambda	.787
Significance of Lambda	<.001

The information above indicates that reasonably successful differentiation was attained between enrolling and nonenrolling applicants based on information contained in the 5 predictor variables. The standardized discriminant coefficients reveal that Number of Applications provided the greatest discrimination, followed by High School Grades, Family Income, and finally SAT score performance[2].

Additionally, SPSS provides a means to assess the overall success of the model by providing a classification function which predicts the group (i.e., enrolling or nonenrolling) to which each admitted student would be assigned based on the variables used in the analysis. In this regard, unstandardized discriminant function coefficients subsequently were used to develop a classification function that predicted each student's enrollment status. The resultant function produced an array of scores (measured in standard deviation units) organized into a continuum of low to high values. In the current example, negative scores were associated with a relatively higher probability of matriculating at Whitman, while positive values tended to be associated with enrolling at other institutions. The function produced through this analysis correctly predicted the enrollment status for 70% of the admitted applicants. A proportional reduction in error statistic, tau, indicated that the above equation represents a 39% improvement over chance (Klecka, 1980: 51). Hence, the results of this phase of the investigation suggest that a reasonably effective and accessible method to differentiate between enrolling and nonenrolling admitted applicants was achieved based on the 1988 survey.

However, the true utility of the above procedures appears when results from the previous survey are used to predict the likely matriculation behavior of subsequently admitted applicants. Toward this end, a telephone survey of 1989 admitted applicants was completed during which time information on the 5 central variables was obtained[3]. In order to create a prediction function for recently admitted applicants, the raw value of each predictor variable was multiplied by its corresponding unstandardized discriminant coefficient derived from the 1988 model, and in this manner a score was obtained for each admitted applicant. The resultant function approximated a normal distribution with a mean of 0, and was constructed so that negative values represented Whitman-likely enrollment, while positive values were associated with enrolling at other institutions.

A brief example illustrates the process. During the 1989 telephone survey, a student reported an overall high school grade point average of "B" (coded as 2), scores of 560 and 450, respectively, on the verbal and math sections of the SAT, a family income of $60,000 (coded as 5), and indicated that she applied to a total of two schools. Each of the original values (e.g., "2", "560", "450", etc.) was multiplied by the appropriate unstandardized discriminant function coefficient (from Table 1), and along with the constant, the terms were summed into a single "enrollment potential" score of -1.6902. Similarly, computations were performed for all other respondents, and resulted in an array of scores associated with probable enrollment at Whitman College.

[2]While the influence of academic performance and income measures on college choice have been demonstrated in other studies, the fact that "number of applications" correlates negatively with enrollment at Whitman provides an intriguing outcome. At least two explanations could account for this phenomenon. First, ceteris paribus, a larger mean number of applications simply could indicate the decreased probability of enrollment. Second, such a measure possibly might be considered as an index of the applicants' subjective academic self esteem--those who think of themselves as highly desirable students may be applying to many institutions. Additional speculation must await future research, however, since the present effort is not intended to test hypotheses nor to suggest theoretical refinements.

[3]Information was obtained from 536 of 757 admitted applicants for whom telephone numbers were available, producing a response rate of 69.5%.

Next, in order to provide the greatest utility for the admissions office, the scores were grouped into smaller, more manageable categories. In this manner a method to treat applicants differently in terms of the types and amounts of attention from the admissions office was developed. It must be acknowledged that the number of resultant groups is somewhat arbitrary, depending on the number of applicants in each group, and on the availability of resources to enhance yield[4]. At Whitman, for example, four groups were identified based on a combination of standard deviation units, and "natural" breakpoints in the distribution of original scores. The resulting groups represent four distinct matriculation categories with different economic, academic, and college-selection characteristics. The groups consisted of applicants who were "very likely" (Group I, 14% of the total), "somewhat likely" (36%), "somewhat unlikely" (36%), and "very unlikely" (Group IV, 14%) to enroll at the College.

Table 2

Actual Enrollment of 1989 Admitted Applicants Compared with 1988 Model Predictions

Predicted Group		Pct. Actually Enrolled	n
I	Very Likely	77.8	72
II	Likely	60.2	191
III	Unlikely	33.7	190
IV	Very Unlikely	23.3	73

At the conclusion of the 1989 admissions season, the accuracy of the predictions based on the above procedures was assessed. First, predicted enrollment (based on the model) was compared with actual enrollment outcomes. A point-biserial correlation between enrollment status and score on the prediction function yielded a coefficient of .36 ($p < .001$), and while not quite as impressive as the correlation for the 1988 study, these results nonetheless merit attention. Additionally, an effort was made to assess the results of the grouped scores in terms of actual vs. predicted outcomes. This information appears in Table 2.

As the above figures indicate, the percentage of actually enrolled admitted applicants decreases when examined in terms of ordered categories of predicted enrollment. Thus, it is clear that the strategy appears to have produced workable results: information obtained from a prior year can be used successfully to predict outcomes for a subsequent admissions season.

Discussion

At this point the results of the empirical techniques may be integrated with political decision-making strategy. To illustrate, Category IV, containing approximately 14% of the candidates, represents those least likely to matriculate at Whitman. Political experts argue that few yield enhancement resources should be allocated to these people, since the odds of their being convinced to attend the institution are comparatively small (these individuals approximate the condition of being strong Democratic voters approached by Republican candidates). However, since this group includes some of the most desirable applicants, it would be very difficult to dissuade admissions officials from attempting to attract them. In response, the institutional researcher should encourage the admissions staff to direct fewer resources to individuals with a relatively greater probability of enrolling at the target institution--namely, those in Group I.

Applicants appearing in Group I (14% of the total) were predicted to be most likely to enroll at the target institution. Political election strategy suggests that the least costly resources should be expended here, since its members already appear to be firmly committed to the institution. Although Group I applicants certainly should not be ignored, by allocating comparatively fewer resources to these individuals, additional support would be available for other groups--including those who would add ethnic, geographic, or socioeconomic diversity.

The applicants that should receive the greatest attention, according to political experts, include those appearing in Groups II and III. Group II, involving 36% of the applicants, includes those who are intermediate in the likelihood of enrolling at the target school. These individuals tend to favor the institution, but are not as firmly committed to enrolling as those in Group I. For this reason, greater effort must be directed to encourage them to matriculate. In comparison, those in Group III (36% of the applicants), while somewhat more likely to matriculate than Group IV applicants, are not strongly motivated to enroll at the target institution. Political theorists maintain that the greatest gains to admissions yield efforts will occur for Groups II and III, inasmuch as the odds are approximately even of their enrolling at the target institution, and because more than 70% of all respondents appear within these groups. Consequently, considerable

[4]The size of each stratum or group can be adjusted to fit the practical needs of individual institutions, since the discriminant function provides an estimate for each applicant. If the prediction equation accounts for a reasonably large amount of discrimination, in the absence of additional evidence it may be assumed that the relationship described by the model is linear. Moreover, if the resultant equation achieves statistical significance, greater confidence may be placed in the results. Thus, at Whitman individuals with scores of -2.000 were judged to be slightly more likely to enroll at the College than those with scores of -1.96. The decision on how many students to include in each group was a matter of convenience.

resources should be directed towards these groups, because of their "swing" status. Also, prior research indicates that Group II and III applicants generally have not made a firm commitment to enroll at a specific institution until shortly before the deposit deadline. Thus, it seems reasonable that appropriate actions to encourage vacillating candidates to enroll would be met with reasonable success.

Caveat. It is important to emphasize, however, that decisions regarding the treatment of admitted applicants should not rely exclusively on the above procedures: other information possessed by the admissions office must be considered as well, including: the candidates' possible "legacy" status, knowledge gathered during personal interviews, and other subjective information. Moreover, criteria useful in predicting successful results at one institution may not be appropriate for others. For this reason the researcher should conduct preliminary cross-tabular analyses in order to identify the attitudinal, academic, demographic, and socioeconomic variables most relevant at the target school. Lastly, since continuous demographic and social changes characterize the pool of college-age high school graduates, it will be necessary to re-estimate the prediction function periodically with updated information.

Also, by relying exclusively upon survey data of currently admitted applicants, completed interviews for all respondents probably cannot be obtained. Consequently, it will not be possible to produce enrollment potential scores for a number of admitted applicants, thus necessitating other strategies for these individuals. The researcher can compensate partially by utilizing data that appear only in the applicants' official record, but this approach excludes the possibility of incorporating other, potentially powerful, predictor variables into the model.

Finally, when providing lists of applicants' names to the admissions office for differential yield enhancement treatment, the institutional researcher must be aware that in a very competitive market, potential abuses of information supplied by this technique could occur. Therefore, the researcher must support admissions practices that are consistent with the ethical standards established by professional associations of admissions officers. At the very least care must be taken to discourage excessively intrusive contact with the applicants, and to avoid the use of questionable practices.

Summary

Although the admissions offices at many institutions engage in efforts to segment the high school student market, comparatively little effort occurs to differentiate admitted applicants based on their likely enrollment. Thus, the targeting philosophy underlying attempts to increase student applications usually is not applied during efforts to increase admitted applicant yield. Given current demographic uncertainties, admissions offices increasingly are examining strategies to increase yield. In this context it seems appropriate that enrollment management officials should examine principles of market segmentation and targeting during yield enhancement efforts. Since not all admitted applicants have the same probability of enrolling at the target institution, such efforts should be targeted most efficiently. The technique outlined in this paper suggests a method to classify admitted applicants based on their likely matriculation. Once this has been achieved, admissions officials can develop appropriate strategies to increase institutional yield, as well as concentrate resources on selected categories of applicants such as those from certain geographic areas, minorities, and selected socioeconomic groups.

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